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After a brief history of the development of the language laboratory, the extent, quality, and problems of current laboratory use at the elementary, high school, and college level is discussed, as is the relationship between laboratory equipment and teaching methods. Current research is briefly reviewed, and areas for further study are indicated. The final section of the article makes prediction about the future of language laboratories, which include (1) greater use of audiovisual aids, (2) significant use of programed instruction, which will make the student more independent of the teacher, and (3) large-scale decentralization of the language laboratory. (AR)

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*The Future of Language Laboratories**

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"MODERN MAN is the child of technology, which is influencing and shaping the progress of all his affairs. But though we be the children of technology, we must be its masters and not its slaves."[1]

I have chosen to start with this quotation for several reasons. It applies to language laboratories but has a broader purpose, to show the proper relationship of machines and man in general. In view of the extravagant claims that have been made for the language laboratory of the future, I wanted to set the reader's mind at rest immediately. There is no question but what machines of many kinds have an increasing role to play in education at all levels, but they are not going to take charge. They will upgrade the teacher, but not replace him.

Just as in commerce and industry machines have changed the nature of man's labor, so in intellectual activities machines are making themselves felt. Electronic computers, which can do routine arithmetical operations with the speed of light, compress years of mathematical computations into hours, or minutes. This is well-known. But what of language? Language is a more personal part of the human being. The tongue is the mirror of the soul, if I may paraphrase a common saying.

Everyone knows that his native language is a most intimate expression of his inner being, not to be tampered with without risk. The mere thought of a computer processing human language seems to threaten a violation of privacy.

Nevertheless, computers are translating language, crudely, to be sure—no better than an elementary student—but the important point is that they are doing it as well as an elementary student. Computers are doing indexing, thousands of pages a year, with savings comparable to those from computation. Computer programs have also been written to make automatic abstracts of articles (not very satisfactorily). Others style text and compose pages by means of tape-operated photo-composing machines or typesetting machines.

As we witness these encroachments on the citadel of language, it is comforting to retreat behind the thought that all these applications deal only with the finished product, as it were, of someone's mind, and this is true. In all these cases words are treated just as though they were strings of mathematical symbols. The semantic part of language remains untouched by machines. Yet in each case, a machine has taken over part of a job that used to be done by a man. The quality of the output may not yet be very good, but it is improving; and as it improves, more and more of man's routine intellectual operations can and will be done by machines; machines are cheaper, faster, and their mistakes are usually more obvious. Teaching is not a routine operation, though drill is. Teaching machines are drilling machines, but the program represents a high degree of teaching skill.

Historical

Now I'd like to jump back in time fifty years or more, from modern computers to a simple apparatus for recording sound on a wax cylinder or disk, a triumph of engineering just as stimulating to the mind of those days as the computer is for us today. The first language laboratory was the first room in which some scientist used apparatus to study language. I may seem to be using the words "study language" ambiguously, but I don't think so. The person who studies wave forms on a kymograph or an oscilloscope is not bringing to bear any more sophisticated part of his mental equipment than the person who studies a foreign language in order to master it. Both are intellectual operations of a high order.

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[1] Julius A. Stratton, "Science and the Process of Management," *Proceedings of the International Management Congress, Spetember 16–20, 1963*, New York: Council for International Progress and Management, 1963.

Both involve analysis. In addition, learning a language involves a great deal of memorization.

The name "language laboratory" was coined for a room in which equipment was used to help study language long after *phonetics laboratory* and *experimental phonetics* were applied to the scientific study of speech sounds and intonation by Rousselot.[2]

Until the 1930's "phonetics laboratory" was used for the most part instead of "language laboratory," and that was quite proper because the laboratory often combined the scientific study of speech, speech correction, and foreign language instruction.[3]

As early as 1929 over 200 students a year at Middlebury College French Summer School in Middlebury, Vermount were taking phonetics courses which required five hours a week of class work, and one hour a week in the phonetics laboratory. Listening, repeating, and memorizing phrases was an integral part of the course. The phrases were chosen to exemplify the sounds of French.[4] Ten booths providing sound isolation were set up, each with a record-player, earphones, and a mirror for watching lip movements. Moreover, there was a recording machine in the next room and the voice of each student was recorded as he read a selection in French at the beginning of the course and again at the end.

I mention this installation because although it was not the first, it probably came nearer to the modern conception of what a laboratory should do than any other of the period. Not only that, but the importance of records for drill exercises, and of recording the student's voice to let him hear himself and evaluate his own progress, was imparted to over 5,000 teachers of French who attended the Summer School between 1930 and 1950. Smaller numbers in the German, Italian and Spanish Schools were also involved. The rapid acceptance of the language laboratory in the United States is in no small measure due to the laboratory experience of a whole generation of teachers at Middlebury. I am happy to have this opportunity to pay tribute to the farsighted work at Middlebury, where I was the laboratory technician for a few summers, since nothing has been published concerning this really seminal laboratory operation.

The story of the rapid spread of language laboratories is too well-known for me to detail it here. It began immediately after the end of the second World War, first with disks and wire recorders. Then the great revolution came with the importation into the United States of the concept of the Magnetophone, using a paper tape with an iron-oxide coating. This is a truly international invention. The oxide coating is a Swiss invention developed in Germany; mylar, the nearly unbreakable plastic base, is French; and the two were put together and mass-produced in the United States.

Labs in schools received further great impetus with the availability of funds from the U.S. government, paying half the cost of the equipment for any publicly-supported school. A current estimate which I owe to Dr. Alfred S. Hayes, Head of Research and Special Projects at the Center for Applied Linguistics in Washington, is that there are now between 6,000 and 7,000 installations in secondary schools and perhaps 1200 or more in colleges and universities in the U.S.[5]

As a matter of general interest I have collected estimates of the numbers of laboratories in as many other countries as possible. Like the figures above, these are subject to the reservation that no definition of "language laboratory" was furnished. The following estimates have been supplied to me, as of the summer of 1964, by those indicated, and I want to take this opportunity to thank them:

Australia—16 (Miss Kathleen McPhee, University of Melbourne)

Belgium—40 (my own guess)

[2] Pierre Jean Rousselot, *Principes de phonétique expérimentale*, Paris: A. Welter, 1897.

[3] Ralph H. Waltz, "Language Laboratory Administration," *The Modern Language Journal*, Vol. XVI, No. 3 (December, 1931), pp. 217–227.

[4] Nicolette Pernot, *Exercices de Prononciation Française, à l'usage des étudiants anglo-saxons* (Editions Phonomatiques), Paris: Rouart, Lerolle et Cie, 1932. The book was accompanied by five records.

[5] Several hundred of these laboratories are in private schools or universities, which are ineligible to receive government funds. In these cases the laboratories have often been financed through gifts of graduates or of parents of students. It is also true that, in spite of more difficult financing, many of the better installations are in private institutions. In the United States the quality of the teaching and of the student body is at least as high in many private institutions as in the public schools.

Denmark—5 (Dr. Max Gorosch, University of Stockholm)
England—about 150 (Dr. J. A. Harrison, Director of the National Committee for Audio-Visual Aids in Education)
Finland—3 perhaps (Dr. Gorosch)
France—152 (The Cedamel Company, Paris)
Germany—150 to 200 (Mr. I. A. Höfig, Arbeitskreis zur Förderung und Pflege wissenschaftlicher Methoden des Lehrens und Lernens)
Holland—15 (Dr. M. Buning, Language Laboratory, Vrije Universiteit, Amsterdam)
Japan—over 200 (Prof. Mitoji Nishimoto, kindness of Mr. Harald Gutschow of Berlin)
Norway—4 (Dr. Gorosch)
Sweden—1 (Dr. Gorosch)
United Kingdom—250 to 300 (Mr. R. H. Milner of the British Council)

Elementary Schools

It is striking that there are practically no figures available for language laboratories in elementary schools. For the most part the question has simply been dismissed by saying that laboratories are too expensive to provide them for the very large number of children at the elementary level. This reasoning is suitable for a business manager, but it seems to me that language teachers should approach the matter from a more idealistic point of view. Little experimentation has been done, though excellent results have been obtained in a few places, l'Ecole Active Bilingue, in Paris, for instance.

Pre-adolescent children learn to speak languages easily by imitation. Therefore, the best time to start one or more foreign languages is in elementary school. I doubt if anyone who has ever taught a foreign language at that level, as I have, would debate the correctness of those two statements.[6] In the United States we have considerable opposition from administrators who claim that the curriculum in elementary school is already too full to introduce language work. This they always say at all levels. We also have extensive opposition, which I would characterize as "disloyal," from secondary school teachers of foreign languages. As the reason for their objection they allege the shortage of experienced teachers for elementary language instruction. Secretly they feel that they, and only they, know how to teach beginning language. One suspects that another reason for their opposition is that they only know how to teach beginning language.

To continue my line of reasoning concerning elementary schools, the laboratory is so effective at higher levels that it could be expected to be even more so here, and to further improve and accelerate the pre-adolescent's progress. Only when we know how effective the laboratory is, can we know whether it is worth trying to find the money to pay for it.

Perhaps I might mention briefly the very extensive teaching of French by television in elementary schools of the United States, England, Canada, and a number of other countries. It is relevant because research[7] conducted under a grant from the United States Office of Education, by Professor Ralph Garry of the School of Education of Boston University, clearly shows that television teaching is effective only if the lessons are followed up in the classroom, either by a teacher who knows French, or by a teacher who does not know French but who uses records or tapes containing supplementary review materials and drills. The latter situation obviously calls for a language laboratory.

With between 2 and 2½ million elementary school children taking French by television, some with excellent, some with deplorable results, the secondary schools have begun to receive many pupils who have had two or three years of French. It is the arrival of these pupils which has crystallized the opposition of secondary school teachers to elementary school language programs. Overtly and covertly they have carried on the battle against them and have succeeded in many cities in persuading administrators who had frequently adopted them as a result of pressure from parents, to drop them. One strategy has been to try to prove that pupils en-

[6] See, for example, Wilder Penfield, "The Uncommitted Cortex," *Atlantic Monthly*, Vol. CCXIV, No. 1 (July, 1964); also his earlier historic work, "The Learning of Languages," *Speech and Brain Mechanisms*, (FL Bulletin No. 62), New York: Modern Language Association of America, 1959.

[7] Unpublished, but available in mimeographed form from the Modern Language Project, 16 Arlington Street, Boston, Massachusetts.

tering secondary school with previous French do no better, in the beginning courses, into which they are usually put, than pupils with no previous French. These courses tend to use a traditional grammar and reading approach. Examinations are based on these skills rather than on speaking ability. In spite of this, and not surprisingly, pupils with previous French often do better.

Secondary Schools

On the secondary level the large number of laboratories in the United States and the growing number in other countries attest to the interest of teachers and administrators. True, a certain number are "fad labs," installed because someone thought the school had to have one in order to be up to date, and sometimes over the objections of the language teachers. In one such case, a high school teacher told me, "Yes, we're going to have a lab next fall, and I don't know what I'm going to do with it. They might as well put an organ in my classroom and tell me to play it."

Any new development may have this unfortunate side effect, but young people do learn to speak and understand spoken language better with the aid of a laboratory, provided the teacher is interested. Let me quote from P. R. Léon's excellent book, *Laboratoire de langues et correction phonétique*.[8] Based on extensive research and personal observation he writes: "Aux Etats-Unis, le même phénomène a eu lieu, et continue souvent encore. Les professeurs décident que les élèves n'aiment pas les machines. Un jour enfin lorsque le professeur est convaincu de l'efficacité du laboratoire, les élèves se mettent à y croire également." In the rest of what I have to say I will assume that we are dealing with a teacher who is eager, or at least willing, to use the means at his or her disposal to do the best possible job of teaching.

This job is defined by Elton Hocking in his fine book *Language Laboratory and Language Learning*,[9] as follows: "The adoption of a technology is, of course, much more than the invention and development of equipment. It is, instead, the creation and improvement of a man-machine system for teaching languages." Of course, much of this "creation and improvement of the man-machine system" has been done and will be done for the individual teacher by others. Just as textbooks are written by those who combine the skills of teaching and textbook writing, so those who are gifted in language laboratory techniques will devise exercises and create materials. Complete courses of study which integrate classroom, laboratory, and homework into an intelligent whole have been badly needed and are beginning to appear.

It has probably been sufficiently stressed in the literature that buying tapes of the exercises of a conventional textbook, then having the student listen to them, repeat them, or respond to them in the laboratory is a poor imitation of effective laboratory work. In fact, many of the shortcomings of laboratories in the past can be traced to the use of this type of material. Yet commerical tapes may have one advantage over those made by the average teacher. They have usually been prepared by native speakers of the language who are not suffering from mike fright. On the other hand, some of these native speakers use an artificial diction instead of normal conversational pronunciation and intonation, which is what our students should learn first.

Teaching materials including laboratory exercises need to be designed differently for different levels of instruction, then used at the levels for which they are designed. This may seem obvious but, in the desire for a wider market, authors and publishers often claim application of their materials at many levels. I remember my feeling of shock when, during the last war, I got a charming letter from a girls' secondary school saying that they were enjoying using a textbook on military French, which a colleague and I had designed for liaison officers.

Because of differences in the maturity of students and in their command of their native language, materials and methods have to be adapted. Also the amount of supervision and the discipline needed at different levels results in various language laboratory techniques. If, in general, secondary school teachers in the United States recommend working with an entire class simultaneously in the laboratory whereas university professors prefer the library system, where students go and do their work in the lab at their own convenience, this is based more on the

[8] Paris: Librairie Marcel Didier, 1962, p. 220.

[9] Monograph No. 2, Washington, D.C.: Department of Audiovisual Instruction, National Education Association of the United States, 1964, p. 19.

different organization of the student's day at the two levels than on any different philosophy of teaching methods.

Teachers themselves often benefit from a laboratory in a way that is rarely listed among its advantages. This is the effect on their own facility in the language. To the extent that high-quality tapes are used, the teacher has an opportunity for repeated contact with a good model. Many teachers have no chance to use their foreign language outside the classroom; so recordings give them a refreshing opportunity to hear a native speaker. Too, in preparing tapes the teacher is impelled to adopt a high standard of performance by the fact that he will hear himself and that others will hear him. This exercise has beneficial results, as I know from personal experience. In other words, benefits to the teachers are not limited to secondary school but extend to the universities, where we have teachers who cannot speak the language they teach. The less said about them the better.

Universities

In universities as in the later years of secondary school, advanced work may be done in the laboratory. Literary masterpieces of prose, poetry, and the drama may be studied for the expressive features introduced by the speaker.[10] There has been an active group in the United States headed by Mrs. Jeanne Pleasants of Columbia University, a respected phonetician and a pioneer in language laboratory methodology, which has for a number of years been studying applications of the laboratory to the teaching of literature. Mrs. Pleasants publishes a *Newsletter* full of valuable suggestions for those interested.[11]

A major application of the university language laboratory is for training teachers not only in the language they will teach but also in the use of the language laboratory. Since most teachers teach the way they were taught, rather than the way they were taught to teach, it is doubly important that the laboratory be used and thoroughly integrated with classroom work in teacher-training institutions. The best practices and the most complete and flexible equipment must be used. This unfortunately is not generally the case in the United States. The majority of our teacher-training institutions have not had language laboratories at all. In fact, I suspect that the majority still do not. The teacher-training institutions in our country have been under strong attack for poor teaching, antiquated methods and philosophy.[12]

Fortunately, the summer institutes run by universities under contract with the United States Office of Education have given many beginning teachers a brief exposure to a language laboratory. From the answers to a questionnaire sent out by Dr. Elton Hocking of Purdue University in 1962,[13] it is evident that a shortage of adequately trained teachers is a major hindrance to effective operation of language laboratories. He writes: "by an overwhelming majority . . . the most serious handicap was identified as 'teachers' lack of special training" (p. 41).

At last materials are beginning to appear which are effective for the training of teachers as well as for students. Particularly good are a set of tapes and a book, *La Structure de la langue française; Pattern drills in French for the Language Laboratory,* by Theodore Mueller.[14] We can expect more contributions in this field soon, as its importance is now widely recognized.

Effect of Equipment on Methods

Let us turn now to the effect that laboratory equipment may have on methods. The word laboratory implies the presence of equipment, which differentiates it from a classroom, but it is what

[10] "Only the student who can pronounce a poem correctly can grasp its complete significance." Pierre Delattre, "Le Français et les laboratoires de langue," *Esprit* (November, 1962), p. 598.

[11] Available on subscription from *Newsletter,* General Editor, Language Laboratory, Columbia University, New York 27, New York.

[12] See Dr. James Bryant Conant, *The Education of American Teachers,* New York: McGraw-Hill, Inc., 1963.

[13] *op. cit.* pp. 37–46.

[14] Available from the Wayne State University Modern Language Audio-Visual Research Project, Detroit, Michigan: book $5.00, tapes $154.50. Reviewed by Edward M. Stack in *The Modern Language Journal,* Vol. XLVI, No. 7 (November, 1962), p. 324, " . . . in these days of extreme lack of truly effective tapes for the lab it is a pleasure to be able to recommend this well-prepared set which is so adaptable to all texts. The students using these tapes will immediately be involved in an active and systematic learning experience, rewarding to student and teacher alike. Prof. Mueller and his colleagues in this project are to be congratulated."

is done with the equipment that is important. In most laboratories the teacher uses, or perhaps one should rather say the students use, tape-recording equipment to provide a model for their imitation, drills to which they are to respond, and facilities for testing.

Whatever the equipment, it should have two principal effects on teaching methods. The first is negative. It should not get in the way. It should be simple enough to operate and flexible enough to allow the teacher to do anything he needs to do in the teaching process. These are fairly difficult requirements. Simplicity of operation means a minimum of controls. The ideal would be to have none, so that the operation would be completely automatic; but this is in direct contradiction to my second requirement of flexibility. Flexibility means the possibility of recording the student's voice, both in order that he may evaluate his own performance and for testing. It means the possibility of monitoring, or two-way communication between teacher and student.[15] It means the student can stop his tape to give time to ponder a reply. It may mean facilities for immediate playback of the last few words.

Every added feature of flexibility means more complexity of equipment and may mean more knobs and buttons, more delays and errors which interrupt the learning process. Much has been done, more needs to be done, to rationalize equipment controls and make them as automatic as possible.

Flexibility entails not only complexity of equipment but also additional cost. This has to be justified on the same basis that one justifies equipment for other laboratories, physics, for instance. There are many instruments in a physics laboratory which are only used part of the time, for particular experiments, for students on a certain level, by the teachers who teach certain courses. The same must be true of a good language laboratory. Not all the possibilities of the equipment will be used all the time, but they must be there when they are needed.

The second effect of equipment on teaching is positive. It helps the teacher to do things which he could not do before. As has been pointed out ever since the introduction of the first recordings into language teaching, you can now have an unchanging model for the student's imitation. I like Hocking's analogy: the "teacher's repetitions can be only approximate and they are thus a moving target for the student; the machine presents a stationary bull's eye."[16]

The laboratory has made possible the evolution of a new rationale of drill: starting with the original recordings, without pauses, designed for memorization, then recordings with pauses to allow time for repetition or response then various kinds of pattern drills, substitution, expansion, and recently programmed instruction. A first-rate treatment of drill procedures by Gustave Mathieu bears the misleading title, "A Brief Guide to Sound Labmanship."[17] Another good one is Paul Pimsleur's "Pattern Drills in French."[18]

Effect of Methods on Equipment

The ideal relationship between teaching methods and equipment is that of the hen and the egg. You can't decide which one came first. They had to evolve together. The evolution of teaching methods, as mentioned above, has brought into being new types of equipment. Just entering the picture is programmed instruction, which requires a pause button to stop the master tape while the student reflects. When he releases the button, the tape advances and gives him the answer he should have found. In one application the student repeats the correct answer, then both the answer and his repetition are recorded and instantly played back to him to drive the point home. All the elements of this equipment are within the present technology; so, as research shows what elements of programmed instruction are valuable, the necessary facilities can be incorporated into all language laboratories. There has been rapid development in the last few years and there is every reason to believe that it will continue. It is a fortunate coincidence for the

[15] Il est pourtant très important que l'étudiant soit contrôlé. S'il répète cent fois la même erreur celle-ci va s'ancrer plus profondément au lieu de se corriger," Léon, *op. cit.*, p. 129.

[16] *Op. cit.*, p. 107.

[17] *The Modern Language Journal*, Vol. XLIV, No. 3 (March, 1960), pp. 123–126. Mathieu is also the editor of the invaluable *MLAbstracts*, available from Professor G. Mathieu, Chairman, Department of Foreign Languages and Literature, Orange State College, Fullerton, California.

[18] *The French Review*, Vol. XXXIII, No. 6 (May, 1960), pp. 568–576.

proponents of the teaching machine that the language laboratory offers a ready-made setting for the testing of their ideas.

Perhaps I might be excused if I mention one or two personal experiences with the effect of teaching methods on equipment. Five years ago, when we installed our first lab at Massachusetts Institute of Technology we bought 20-minute endless-loop cartridges—20 minutes was considered a good length; the students could go through the lesson twice in an hour. We decided on cartridges to eliminate waste of time in rewinding. Little by little we have found that shorter drills and exercises are more effective. All of our cartridges are now 10 minutes or less; that is, except for selections of prose or poetry for advanced students.

Another personal reminiscence concerns the value of recording the student's voice and letting him hear it. Having worked in the Middlebury College laboratory described above and having observed the rapid improvement in performance when a student recorded his voice and played it back on the Brush Mirrophone before the war, I became a firm proponent of the record-compare laboratory. I can't help relating a conversation with Professor André Malécot of the University of Pennsylvania, who visited us at Massachusetts Institute of Technology last year. As we walked back from lunch he was arguing that letting the student record his voice and then listen to it is a waste of time. He happened to be carrying a new moving-picture camera, and I asked about it. He said he and his wife were going skiing and were going to take pictures of each other so that they could study their form and improve it.

This evidence and the evidence of musicians, actors, and public speakers who record their performance in order to study it, clearly indicates to me the desirability of providing for recording in the laboratory.

Hearing and speaking are closely related. Let us take two statements: "You can't hear yourself while you're talking,"[19] (obviously we do hear ourselves while talking but we don't perceive the detail), and "you can't pronounce anything that you can't hear."[20] If these statements are both true, as I have every reason to believe they are, then it follows that the student can hear how he says something only by recording his voice and playing it back. The audio-active laboratory is erroneously claimed by its proponents to help in this.[21] It cannot. All it does is to attenuate the voices of others; at best it gives one the illusion of being in a room alone. The physiological and psychological factors that prevent you from hearing your own voice objectively are still present.

The great advance provided by the complete language laboratory is that it can break the vicious circle described above. By interposing recordings in the cycle, hear model—speak, you get a new cycle which provides for self-improvement, hear model—speak—hear model again—hear own speech.

On the basis of my teaching experience I believe improvement in pronunciation is a stepwise process. You hear the model and you hear your own imitation. You estimate the difference. You try again and narrow the gap, each time setting your sights higher, so to speak. In time the individual reaches a plateau, his natural limit at the moment. This may be raised by further practice over a period of time up to another plateau which seems the best he can do unaided. The laboratory introduces new possibilities. I have repeatedly seen students reach their individual plateau outside the lab, then go on to improve their performance in the laboratory. Again a pleateau is reached, and it in turn may be

[19] "Elle énonçait d'abord le principe bien connu mais toujours oublié qu'on n'entend jamais ses propres fautes lorsqu'on parle une langue étrangère." Jeanne Vidon-Varney (Pleasants), *Pronunciation of French: Articulation and Intonation*, Ann Arbor, Michigan: Edwards Brothers, 1933, cited by Léon, *op. cit.*, p. 33.

[20] " . . . la voix ne reproduit que ce que l'oreille entend. En d'autres termes un sujet ne sait réaliser avec certitude que ce qu'il est capable de contrôler." Alfred Tomatis, *L'Oreille et le langage*, Paris: Les Editions du Seuil, 1963, p. 104.

Léon, *op. cit.*, pp. 132–133, gives several other references on this point, summarizing as follows: "Mais une chose est certaine—quel que soit le moyen par lequel l'oreille est amenée à entendre le son nouveau—*si ce son n'est pas perçu correctment il ne sera jamais reproduit correctement*, ou seulement par hasard. *Le rôle de l'audition est primordial.* La première fonction du laboratoire sera donc l'entraînement auditif, ce qui n'exclut nullement un entraînement à l'expression orale parallèle, bien au contraire."

[21] "To Record or Not," *The Modern Language Journal*, Vol. XLIV, No. 6 (October, 1960), pp. 278–279.

raised with the aid of individual corrective work by a trained phonetician. The question of whether each adult has an individual plateau beyond which no amount of assistance will take him remains open, though it seems probable. In some way very young children seem to be able to attain native performance in a foreign language without these plateaus along the way. This ability drops off sharply at adolescence, hence the importance of starting a first foreign language young.

In view of the above, it is clear that I disagree strongly with those who would postpone recording until the later stages of instruction, for instance, James M. Watkins: "in a beginning course, though it may be chiefly based on pattern assimilation as it is here, student *recording* is actually of little real value. In the beginning course, therefore, our students use the master machine alone as just described and record only when taking a quiz. In the more advanced courses, however, and in phonetics particularly, facilities for individual recording are indispensable."[22]

As to the statement that recording is indispensable in phonetics, this is true, but here the implication is that the work in phonetics takes place only in advanced courses. If this refers to phonetics theory and the teaching of corrective methods to teachers, these would indeed be in advanced courses, but the methods of phonetics must be used from the very beginning to establish a correct pronunciation. As everybody knows, once well rooted, wrong pronunciations are almost impossible to eradicate.

One of the debatable points in methodology is whether the student's native language shall be used or excluded at various levels. The audio-lingual method, a lineal descendent of the direct method, has generally proscribed the native language. The student is to be given sequences of phonemes, the meaning of which he has to deduce from the context, verbal or visual or both and avoid all reference too his native tongue. At the same time the proponents of this method, pointing to the work of the structural linguists at the English Language Institute of the University of Michigan and elsewhere, are espousing the philosophy that a comparative analysis of the phonology and syntax of the native language and the foreign language should be made, then only the elements which differ in the two languages are to be taught. Implicit in this latter approach is the idea that the student will make a transfer of all the phonemes and grammatical constructions which the two languages have in common. Unless I am dreaming, this is a flat contradiction to the basic philosophy of the direct method,

A point which should be clarified is the question of whether one should start pronunciation training with phonemics or phonetics. This argument is meaningless to me because I see the phoneme as a theoretical concept pertaining to *langue*, which is represented in *parole* by one or another of its allophones. So no one can pronounce a phoneme, only allophones. Nevertheless, a confusion does arise. For instance, P. Léon:[23] "La discrimination phonémique sur laquelle repose tout le système des oppositions significatives de la langue est évidemment l'essentiel, ainsi qu'il a été établi par le mouvement structuraliste. Il est donc entièrement justifié, au *stade élémentaire* de s'en tenir au système phonémique . . ." He does immediately contradict this statement: ". . . la distinction phonémique ne suffit pas à corriger un accent. La discrimination auditive doit, pour être efficace, sur le plan orthophonique, s'accompagner de jugements valeur du système phonique tout entier, en considérant l'aspect phonétique comme complémentaire de l'aspect phonémique." If Léon and Watkins are suggesting that correction of accent need not take place from the beginning, they are very wrong.

Research

Good research is the only sound basis for the language laboratory of the future. As Hocking says:"The language laboratory and the materials are too recent for us to know all the answers to the questions; indeed, we do not yet know all the questions."[24] Not enough research has been done and some of what has been done is woefully defective in design. When there are uncontrolled variables, concealed assumptions, or ob-

[22] "The Library System and the Language Laboratory," *The French Review*, Vol. XXXIV, No. 1 (October, 1960), pp. 60–66.

[23] *Op. cit.*, p. 147.

[24] *Op. cit.*, p. 39.

vious bias in interpretation, the research can only do the profession more harm than good. Such is the case with the Keating report.[25] It was published after a campaign of publicity in the press announcing that Keating had shown language laboratories to be worthless, and with a large free mailing to school administrators; so a careful attempt has been made to determine exactly what the report proved and what it did not. What it proved was that Keating knew nothing about the language laboratories in the schools he studied, whether they were used or how they were used. Apparently his principal purpose in publishing the report was to gain personal notoriety. In this he succeeded. In the April 1964 issue of *The Modern Language Journal* a symposium of four articles analyzes the Keating report in detail.

Quite the opposite is the case of the experimental work done by Sarah W. Lorge,[26] Bureau of Audio-Visual Instruction, New York City Board of Education. This is carefully designed, well carried out, and completed by a thorough statistical analysis. For the first time the value of frequent laboratory sessions and the superiority of audio-active-record over audio-active labs is clearly shown. Another good job is that by Peter Doyé at the Pädagogische Hochschule, Berlin.[27] This is careful, thoughtful work which should be imitated. One would appreciate a few more details about the *modus operandi*. Were the students' voices recorded and played back to them? This is not clear.

A program of research of immediate application to language laboratory equipment is reported in two papers, "Language Learning and Frequency Response," by M. Buka, M. Z. Freeman, and W. N. Locke,[28] and a second now being prepared for publication. Studies were made of the ability of American students to distinguish phonemic contrasts in German and in French under different conditions of frequency response of the language laboratory equipment. To summarize the results: as to discrimination, a system frequency response of less than 7300 cycles per second and especially below 5000 cycles per second prevented a substantial number of high school students, who had never studied a foreign language, from perceiving phonemic contrasts in German and French. Low frequency limitation, when frequencies below 500 and 1000 cycles per second respectively were filtered out, gave much the same picture; i.e., the difficulty of recognition of unfamiliar phonemic contrasts increased. Consonants are more affected than vowels by both high and low frequency limitation and German shows a much clearer picture than French. Evaluation of the students' pronunciation on the whole supported the conclusions of the discrimination tests.[29]

These results supply a small part of the answer to the puzzle as to what the specifications for language teaching equipment should be, confirming the conclusions of Alfred S. Hayes in his book, *Language Laboratory Facilities,* which is a major work of synthesis.[30] Among the most valuable parts of the book is the appendix: "A Sample Procurement Specification." This is the epitome of what one needs to know to buy a good laboratory, except that it envisages mainly individual tape recorders at student positions, which is not the simplest to operate, the most flexible, or the most trouble-free equipment. The future of the laboratory belongs to automatic, remote-control equipment.

As one reads Hayes' book, that of Tomatis, and the other research which bears on language laboratory equipment, one is discouraged by how little of it there is and by the difficulty of drawing practical conclusions from it. Hayes admits

[25] Raymond F. Keating, *A Study of the Effectiveness of Language Laboratories,* Institute of Administrative Research, Teachers College, Columbia University, New York, 1963.

[26] "Language Laboratory Research Studies in New York City High Schools: A Discussion of the Program and the Findings," *The Modern Language Journal,* Vol. XLVIII, No. 7 (November, 1964), pp. 409–419.

[27] Reported in his article, "Französischunterricht im Sprachlabor" in *Programmiertes Lernen und programmierter Unterricht,* Heft I, 1964, pp. 32–37.

[28] *International Journal of American Linguistics,* Part II Vol. 28, No. 1 (January, 1962), pp. 62–79.

[29] The experiment was conducted as follows: Pair tests were used. Two words differing by a single phoneme were pronounced. Then one was repeated and the student indicated by a check mark in the proper column on a test sheet whether the first or the second member of the pair was repeated. This was for discrimination. As the student heard each member of the pair the first time, he repeated it. This was recorded and later evaluated by native speakers. This gave pronunciation scores.

[30] Alfred S. Hayes, "New Media for Instruction, 4," United States Office of Education Bulletin 20124, 1963, No. 37.

that his specifications are incomplete.[31] Tomatis claims that the frequency response of all equipment used for the teaching of English should go up to 12,000 cycles per second.[32] He does not mention how low the frequency response must go nor how flat it must be.

One thing has been clear for a long time. It is that the best criterion for excellence of sound reproduction in the laboratory is naturalness. The engineers' criterion of intelligibility is worthless in the foreign language teaching context. But there is no scientific definition of naturalness. May I urgently recommend to any language teacher who is interested and able to work with engineers that we need far better sound quality than the average laboratory has, and that we will not get it until we can prove by further research what happens when we do not have it.

The Future

My title is *The Future of Language Laboratories* and it may seem that I have been a long time getting to it. Yet one can hardly talk of the future except in terms of the present. In talking about the laboratories of yesterday and today I have mentioned the directions in which they should develop. Moreover, in a very real sense the future is already here. Around us, unknown perhaps, are people doing outstanding work. The best methods and the best equipment will be imitated. Careful research with publication of the results is a major item for the future of the laboratory. It is needed on the part laboratories can play in elementary schools. It is needed to determine the best proportions of listening to tapes, repeating, recording, and comparing at different levels. This is an extremely difficult area and studies so far have been inconclusive. It is needed on the quality of tape, on the length of pauses, how many voices should be used, how many repetitions, what is really most effective in helping ability to learn, as opposed to motivation. The same is true of the contribution which a visual component can play. About the best that can be said so far is that it improves motivation. I agree with Howard Lee Nostrand of the University of Washington when he writes, "In my opinion, the sound film is a more effective medium than tape for modeling a foreign language and the accompanying behavior patterns. I hope that audio-visual models will become more usable in language labs, with 8-mm sound projectors and cartridges. Meanwhile the showing of a film can usefully be followed by audio exercises which use the sound track of the film and which prompt the recall of the visual component."[33]

As to the equipment of the future there seems no reason to believe that the sound system will be basically different from that of today. New facilities will be added, no doubt, but magnetic tape with its high-fidelity capabilities and its ease of recording, erasing, and re-recording will continue to be the heart of the language laboratory. The contribution of films, slides and other pictorial material to enrich the auditory has been badly neglected, but it seems likely that within ten years video tape or some similar medium will be widely used. Then we shall have the same advantages of flexibility and reduced cost in the visual domain that we now have in the auditory.

Another area that should be explored is that of stereo or binaural sound. The remarkable results with music and drama should not be overlooked. Many shudder at the further expense, but again I say that it is our first duty to learn what is best for pedagogy, then worry about the cost afterward. Money for new experiments is relatively easier to get than money for day-to-day operation.

The introduction of programmed instruction will mean that the labortory will play a larger part than it has previously. The shortage of qualified teachers and the success of experiments in the teaching of foreign languages by audio-visual media without experienced language teachers[34] probably indicates a large extension of this sort of teaching both in and out of the laboratory. The concept of independent learning in the laboratory makes one wonder if it might not come to be called the Language Learning Center, as someone has suggested.

[31] *Op. cit.*, p. 60. "Some things are definitely known and others are disputed or imperfectly understood."

[32] *Op. cit.*, p. 125. "La linéarité qu'il faut exiger est absolument nécessaire jusqu'à 12,000 hz, par exemple, pour l'anglais."

[33] Private communication to the author.

[34] See, for example, Charles E. Johnson, Joseph S. Flores, Fred P. Ellison and Miguel Riestra, *The Development and Evaluation of Methods and Materials to Facilitate Foreign Language Instruction in Elementary Schools*. 805 W. Pennsylvania Avenue, Urbana, Illinois: University of Illinois Foreign Language Project, 1963.

At the same time, there is a real possibility that decentralization may change this picture. In residential colleges in the United States there is already a feeling on the part of administrators that too many separate spaces have to be provided for each student. He has the room in which he sleeps, a seat in a classroom, a seat in the library, and one or more places in various laboratories. The question is being asked whether the total amount of space required by the university cannot be radically reduced by giving the student remote access from his room or from an adjoining study area to the laboratories, to recorded lectures, and to the library. Under this plan each student would have a closed circuit television apparatus with which he would see and hear the lessons he needs, plus the possibility of interacting with a large program source and of calling upon a teacher for assistance. There is no reason at all why the language laboratory should not be decentralized also, with individual student positions in the library, in the students' living areas, or even in their homes.

A step in this direction is a new lab under construction for Ohio State University. At the other end of the spectrum is the design for the new laboratory for Middlebury College where individual rooms will be provided for the student.[35] This is not as much of an extravagance as it may seem because, if the rooms are properly designed with walls which are not parallel and adequate sound treatment on the floor and ceiling, a loud-speaker can be used instead of earphones, giving much better sound quality. Still, one wonders why the final logical step was not taken: why bring the students together in one building at all? Why not instead provide these rooms at strategic points in the dormitories, the library, and other buildings on the campus?

In non-resident universities we shall see in our lifetime students attending the university, doing laboratory work, and taking their examinations, all by means of a special television receiver and console which they can rent for the duration of their period of instruction. This is made possible by the mammoth computer as a public utility with service to subscribers at a distance over telephone lines, which is only a year or two away. It will profoundly affect education as well as business.

Over the years the original concept of the phonetics laboratory combining the work that now goes on in the language laboratory with research in phonetics has been lost. This is unfortunate, but inevitable with the multiplication of language laboratories; for many of the teachers who are now using laboratories know little of phonetics. Still, many of the devices used in phonetics research or their offspring should eventually be brought into the language laboratory to assist in corrective work—the sound spectrograph, the speech stretcher, and apparatus for measuring loudness, pitch, and syllable rate, for instance.

Translating machine research can also be counted on later for computer programs which will evaluate the correctness of sentences produced by a learner, since identification of syntactical construction is a prerequisite to translation. As to the spoken language, it is more resistant to machine processing, but eventually we should also have programs to evaluate the acceptability of pronunciation and intonation.

To conclude, the major changes that I see in teaching methods in the laboratory in the next decade involve the techniques of programmed instruction, thus making the student more independent of the teacher; a greater emphasis on the visual, to provide improved motivation and a better understanding of the cultural background of the language to be learned, and large-scale decentralization of the laboratory.

As I see it, the teacher will do less "live" presentation of factual material to classes of students, less drill, but more advisory, consultative and corrective work with individual students. He will be freed from the drudgery of repetition required to help the student build auditory discrimination, the mastery of the paradigms, and the rules of grammar. He will be deprived of the questionable joy of delivering the same lectures annually to captive audiences. In their place he will have to work harder than ever finding, organizing, and preparing audio and visual materials. The technological revolution of language teaching is upon us. Machines are willing slaves, cheaper and more reliable than human beings. We shall have to master them, for I am afraid that those who are not willing to make the effort to master the machines will be replaced by others who are.

[35] Hocking, *op. cit.*, pp. 170–171.